

## Pediatric rehabilitation research cluster



### ***Principal investigators***

Prof. dr. M. Granitzer (Child Nutrition & Health Project)

Prof. dr. K. Klingels (Developmental coordination disorders)

Prof. dr. M. Vanvuchelen (Autism spectrum disorders & coordination of pediatric rehabilitation research)

### ***Postdoctoral researcher***

dr. M. Braeken (Psychology)

### ***Research background***

Although significant advances in high-risk obstetric and neonatal care have resulted in improved survival of infants born preterm, the prevalence of a broad range of mild motor problems in children increased also. Mild motor problems may occur solely, termed developmental coordination disorders (DCD), or may co-occur with other developmental disorders, including autism spectrum disorders (ASD). Children with mild motor problems have difficulties to learn daily living skills, which is an important factor for their long-lasting lack of autonomy and unsuccessful outcome in adulthood. A deeper insight in underlying mechanisms of mild motor problems may optimize diagnostic tools and intervention programs. Early identification of mild motor problems can lead to earlier entry into intervention programs that can support improved developmental outcomes.

### ***Research activities***

The main area of pediatric rehabilitation research at REVAL is dedicated to the underlying mechanisms of mild motor problems in children with DCD and ASD. Motor development, the capability of motor learning and motor performance are studied in these populations from infancy to early adulthood. Potentially important mechanisms underlying mild motor problems are: aberrant

action-observation and atypical movement control. Both are crucial conditions for the development of intentional behavior as well as for motor learning processes. Furthermore, the pediatric research cluster investigates acquired development problems due to malnutrition and extreme poverty. This project is inspired by the Millennium Development Goals of the United Nations and is conducted within the International Child Nutrition & Health project.

The ongoing research projects of the pediatric rehabilitation research cluster aim:

- (1) to gain insight in the relationship between action observation and motor control, action observation and imitation, imitation and motor learning, observational learning and behavior modification;
- (2) to detect early sensorimotor signs in high-risk children for developmental disorders;
- (3) to detect the effect of related intervention programs.

*(1) The relationship between action observation, motor planning and motor control, imitation, observational learning and motor learning and behavior modification are examined in different ways and at different ages.*

Video clips are shown to infants from the age of one year in which they observe an adult performing simple goal-directed actions. With the use of eye-tracking techniques the infant's predictive eye movements are recorded, which indicate the level of understanding and prediction of observed actions. This level of action observation and understanding is compared with the infant's spontaneous actions (relation with motor control) and copying behaviour (relation with imitation and motor learning). In addition, we examine the stress level and stress regulation during action observation by focusing on the autonomic nervous system, by using pupillometry and heart rate variability measures. The autonomic nervous system enables the child to respond adequately to new or challenging situations and tasks.

At preschool age, we investigate imitation development and motor learning capabilities with the use of standardized tests.

At primary school age, we investigate the link between motor planning and execution, including dexterity, power regulation and mirror movements. With standardized instruments we gain insight in underlying processes of motor planning and execution during the acquisition of daily living skills.

At adolescence we investigate the accuracy and speed of action prediction and its relation with action planning and execution.



## *2) Early sensorimotor signs in high-risk children for developmental disorders*

The pediatric rehabilitation research cluster explores early sensorimotor indicators of ASD in high-risk NICU infants. Further, we investigate the diagnostic value of imitation problems for the diagnosis of ASD at preschool age. The Preschool Imitation and Praxis Scale (PIPS) is developed and standardized

according to the results of more than 600 Flemish children between 12 and 59 months. In collaboration with the University of Salamanca, the Preschool Imitation and Praxis Scale (PIPS) is adapted and standardized for the Spanish population. Furthermore, within the context of the Child Nutrition & Health project, we investigate the risk for growth and developmental delay in children who survive from malnutrition in the Jimma region of Ethiopia. The developmental level of each child at risk is determined after medical and nutritional help is given. For this purpose a cultural adapted developmental test, the Denver II Jimma is constructed in close collaboration with a multidisciplinary team at Jimma University. The Denver II Jimma is standardized according to the results of 1680 healthy Ethiopian children. Today the test is systematically used in the regional hospitals and schools, and rural health care centers.

### *(3) Effect of related intervention programs*

The effect of imitation training in young children with ASD by means of humanoid robots is being investigated in collaboration with researchers of the Vrije Universiteit Brussel. The effect of action-observation training in children with DCD is investigated in collaboration with the research group of neuromotor rehabilitation of KU Leuven. The added value of motor, social and physical stimulation to the standard medical and nutritional program for children with severe acute malnutrition, or to existing programs of the SOS villages for children who live in extreme poverty, is being studied in collaboration with researchers of the Jimma University of Ethiopia.



### ***Operational methods and techniques***

Anthropometry and hand grip measurements

Eye-tracking technology, eye movement measurements and pupillometry (Tobii)

Quantitative measurements of dexterity, bimanual power modulation, mirror movements

Neurophysiological measurements, including heart rate variability, stress measurements

Developmental screening and assessment

Psychometrics

### ***Collaborations***

The pediatric rehabilitation research cluster works closely together with researchers of other research institutes of Hasselt University (f.i. IMOB, Prof. dr. Tom Brijs, Prof. dr. Ellen Jongen, Dr. Veerle Ross); of the Leuven Autism Research Consortium LAuRes-KU Leuven (Prof. dr. Jean Steyaert, Prof. dr. Ilse Noens, Prof. dr. Johan Wagemans, Prof. dr. Kaat Alaerts) and neuromotor rehabilitation KU Leuven (Prof. dr. H. Feys), with researchers of the group of Robotics & Multibody Mechanics of Vrije Universiteit Brussel (Prof. ir. Bram Vanderborght), of the CAPHRI School of Public Health and

Primary Care at Maastricht University (Prof. dr. Caroline Bastiaenen, Dr. Eugene Rameckers), of the University of Salamanca (Prof. dr. José Calvo) and with clinical centers such as the neonatal intensive care unit of Ziekenhuis Oost Limburg and rehabilitation centers for children with autism spectrum disorders. For the Child Nutrition & Health project there is a multidisciplinary collaboration with researchers and therapists from the Jimma University (Ethiopia), PXL Health Care, Ghent University, and the Institute of Tropical Medicine Antwerp.

### ***Funding***

Research of the pediatric rehabilitation research cluster is funded by the Research Foundation Flanders (FWO), the Foundation Marguerite-Marie Delacroix, the ICT Community for Autism Spectrum Disorders of the King Baudouin Foundation, VLIR-UOS and BOF Hasselt University;